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The SPM study of oligonucleotides consisting of repeated nucleotide sequences

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The physical properties of DNA molecules, both natural double-stranded and synthesized single-stranded, are currently being actively studied. Thanks to the invention of scanning tunneling (STM) and atomic force microscopes (AFM) it became possible to study various nanoobjects at the molecular and submolecular levels. Obviously, that DNA molecules, and in particular oligonucleotides, are no exception. Synthesized single-stranded DNA sequences consisting of only one type nucleotides, in which the nitrogen base is only adenine, thymine, guanine or cytosine are of particular interest.

The interest in the processes of charge transport in DNA molecules is very high, due to prospects of using these molecules in nanoelectronics. Attempts to measure the electrical resistance of DNA give contradiction results [1-3]. The ambiguity of the results is influenced by the experimental conditions and the type of DNA molecules under study [4], namely: length, nucleotide composition, different sequence of nucleotides in the DNA chain, the number of chains in the molecule.

We can measure the current-voltage curve of a biomolecule using STM. For this, the molecule must be placed between two electrical contacts, one of which is a conducting probe of the microscope, and the other – the substrate surface fragment.

We set the task of performing the series of experiments to study the conductivity of oligonucleotides depending on their nucleotide composition. In the report we will present the results of STM/STS studies of oligonucleotides consisting of repeated nucleotide sequences of only one type, for example, thymine – $d(T)_n$, where n is the number of such nucleotides.

First, we obtained a silver substrate by thermal spraying of silver in vacuum on the mica surface. Next, the obtained substrate was coated with the studied molecules. Then we carried out STM study of the silver surface with immobilized oligonucleotide molecules by the constant tunneling current mode. In addition to obtaining a number of STM images and identifying oligonucleotides on them, the current-voltage curves of single molecules have been measured. In this case, the current-voltage curve is the dependence of the tunneling current on the applied voltage between the probe and the silver substrate. The current-voltage curves were measured several times at each point, and then the data were averaged.

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1. H.W. Fink, C. Schonenberger, *Nature* **398**, 407 (1999).
2. D. Porath, A. Bezryadin, S. De Vries, et al., *Nature London* **403**, 635 (2000).
3. T.I. Sharipov, R.Z. Bakhtizin, *IOP Conf. Series: Mat. Sci. Eng.* **256**, 012009 (2017).
4. M. Iijima, T. Kato, S. Nakanishi, et al., *Chemistry Letters* **34** (8), 1084 (2005).